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DESCRIPTIONS OF NEW SPECIES OF ACHATINELLIDÆ FROM THE
HAWAIIAN ISLANDS.

BY D. D. BALDWIN.

At the present time the total number of described species of *Achatinella*, after eliminating the *Auriculella* and *Leptachatina*, is about 330. Of these 102 are manifest synonyms or varieties. Some of the remaining species are closely allied, and nearly all exceedingly variable.

In the past twenty years only five species have been added to the list, though during this period several new regions have been explored and many new forms discovered. Strange as it may appear, large districts remain yet to be explored. These will require much research, as well as considerable time before the molluscan life and its exact distribution can be fully ascertained, for the habitats of the *Achatinella* are our lofty and rugged mountains, covered with almost impenetrable forest jungles, and furrowed by deep gorges, often difficult of access, a species being often restricted to a single isolated mountain ridge or gorge.

The inconstant and variable characters which many of the species of *Achatinella* exhibit, the uncertainty of some of the species already published, and the somewhat confused synonymy of the group, all contribute to render difficult the matter of affirming new species. Of great importance is the geographical position or distribution of a species. Differences in the external appearance and color of the animals furnish specific tests of essential value. Peculiarities in the sculpturing and color of the earlier or embryonic whorls have proved of value in determining some of the species. An experience also of over forty years in collecting and studying the habitats and distribution of *Achatinella* may be to some extent a guarantee for the validity of the new species herewith presented.

We are indebted to Rev. Prof. Gwatkin, of Cambridge, England, and Mr. H. Suter, of New Zealand, for notes regarding the lingual dentition of the species of *Achatinella*. They indicate two very distinct divisions of the genus, as founded on the structure of the radula.

Section first. No jaw; only a chitinous, transparent membrane covering the lips. Radula broad, oblong. Teeth of the radula very numerous, en chevron, rows sloping obliquely backward; the central tooth long and slender, often obsolete; the laterals and marginals all of the same type, base narrow, head rather broad, the denticles varying in number from five to seven, in the last marginal from four to two.

To this section belong the following subgenera of *Achatinella*, viz.: *Achatinellastrum* Pfr.; *Bulimella* Pfr.; *Apex* von Martens; *Partulina* Pfr.; *Newcombia* Pfr.; and *Eburnella* and *Perdicella* of Pease. The species of these subgenera are all arboreal in their habit, and their dentition is practically indistinguishable, except that in some species the central tooth is absent or slightly varied.

Section second. Jaw present; arcuate, strong, not ribbed. Radula oblong, not wide. Teeth quadrate, in nearly straight rows; centrals small, narrow, sometimes faintly tricuspid; laterals larger, bicuspid; marginals bicuspid or multicuspid.

To this section belong the subgenera *Amastra* H. & A. Ad., and *Laminella* Pfr. The species of the former are terrestrial, and those of the latter either terrestrial or living on low shrubs. The differences in the number of teeth are small, and the variations of shape trifling.

It thus appears that in the majority of the generally accepted subgenera of *Achatinella* there is no possibility of separating the sections by differences in the form of dentition. The terrestrial species, or those tending to terrestrial habits, are characterized by the presence of a jaw; the arboreal species, by its absence. The group *Amastra*, including perhaps *Laminella*, are entitled to separate generic rank.

Section **ACHATINELLASTRUM** Pfeiffer.

Achatinella multizonata, n. sp. Pl. X, figs. 1, 2.

Shell dextral, imperforate, moderately solid, elongately conical, apex subacute, surface shining, striated with fine lines of growth, under a strong lens showing very numerous, extremely minute decussating striæ; apical whorls smooth, scarcely decussated. Color white, variously striped with numerous dark brown lines and bands, some on the base and others spiral. Whorls 6, lightly marginate above, convex; suture lightly impressed. Aperture oblique, oval, white, the dark bands of the exterior visible within; peristome

acute, thickened within, slightly expanded, white, the dark lines of the exterior marked on the inner edge; columella purplish brown, terminating in a strong, oblique, tortuous fold.

Length, 18; diam., 10 mm.

Habitat, Nuuanu Valley, Oahu.

Animal, when extended in motion, longer than the shell. Mantle brown, lighter on the outer edge. Foot above and below light brown; posterior portion tapering. Tentacles long and slender; these, with the head above, slate color.

A great variety of transition forms occur between this species and *A. bellula* Smith, which is found on the neighboring mountain ridges of Nuuanu Valley, and is a much larger shell. The animals of the two extremes are specifically different. The mantle of the latter is black, whereas that of the former is brown, and that of the intermediate forms varies from black to brown.

Achatinella Juddii, n. sp. Pl. X, figs. 3, 4.

Shell dextral, imperforate, solid, pyramidally conical, apex obtuse; surface shining, covered with very delicate incremental lines; the nuclear whorls smooth. Color light gray, shading into light chestnut on the apical whorls, the gray more intense under the cuticle; with two black lines, one below and one at the periphery, the latter faint and continued on the spire; between the lines a white band which revolves on the suture to the very tip of the apex. Whorls 6, margined above, slightly convex; suture lightly impressed. Aperture oblique, oval, white, the light gray of the exterior surface exhibiting a darker shade within; peristome acute, slightly thickened within, a little expanded, columellar margin very slightly reflected, white, the coloring of the exterior dark lines reappearing rather more intense on the inner edge; columella white, terminating in a moderately developed flexuous fold.

Length, 15; diam., 9½ mm.

Habitat, Halawa, Island of Oahu.

No opportunity for an examination of the animal has yet occurred. The shell is typically very distinct from any other known species. The light chestnut band on the apical whorls is a characteristic and invariable feature. The basal portion of the shell sometimes has a yellowish hue. In immature shells the colors are more intense.

Named in honor of Hon. A. F. Judd, Chief Justice of the Republic of Hawaii, by whose son the shell was discovered.

Achatinella Ernestina, n. sp. Pl. X, figs. 5, 6.

Shell sinistral, subperforate, moderately solid, ovately conical; apex subacute; surface shining, obliquely striated with delicate growth lines, under a strong lens exhibiting numerous, very close, and minute decussating striae; apical whorls smooth, scarcely decussated. Color yellow, lighter above; variously striped with transverse, dark chestnut bands, the more constant being one bordering the suture, one at the periphery, spiral above, and one encircling the base. Whorls 6, narrowly margined above, somewhat convex; suture moderately impressed. Aperture oblique, oval, faintly exhibiting the dark bands of the exterior; peristome acute, somewhat thickened within, slightly expanded, white, the coloring of the exterior bands appearing on the inner edge; columella white, terminating in a prominent, oblique, tortuous fold.

Length, 21; diam., 12 mm.

Habitat, Nuuanu Valley, Island of Oahu.

The animal, when extended in motion, as long as the shell. Mantle light brown, sprinkled with black and margined on the outer edge with an interrupted reddish-yellow line. Superior portion of foot light brown, thickly studded with small slate spots; under portion of foot light brown with a slate tinge. Tentacles dark slate.

This species is found near the mountain ridge separating the habitats of *A. castanea* Rve. and *A. fuscolineata* Smith; and in general appearance and characters it is intermediate between these species. It is much smaller than the former and rather larger than the latter, and differs from them both in the arrangement of colors. Transition forms between it and both of them are numerous. An item of specific value is the difference in the exterior appearance and color of the animals.

Section **BULIMELLA** Pfeiffer.

Achatinella luteostoma, n. sp. Pl. X, figs. 7, 8.

Shell sinistral, imperforate, solid, ovate, spire convexly conical, apex obtuse; surface shining, marked with fine growth lines, under a strong lens seen to be decussated by close, extremely minute spiral striae, apical whorls smooth. Color white, with a reddish-yellow lip. Whorls $5\frac{1}{2}$, margined above, slightly convex. Suture moderately impressed.

Aperture oblique, sinuately oval, white within. Lip obtuse,

thickened within, columellar margin very slightly reflexed, extremities united by a very thin yellowish callus. Columella reddish yellow, terminating in a strong tortuous fold.

Length, $15\frac{1}{2}$; diam., $9\frac{1}{4}$ mm.

Habitat, Palolo to Niu, Island of Oahu.

It is *Bulimella rosea* Swains, var. Hartman, Proceedings Academy of Natural Sciences of Philadelphia, Jan. 31, 1888, p. 30.

In occasional examples the basal portion below the periphery is light brown, and sometimes a bright chestnut spiral band encircles the periphery.

Dr. Hartman, in his valuable Synonymic Catalogue of *Achatinella*, has noted this species as a small variety of *A. rosea* Swains. When we sent him the shell we were unacquainted with the animal. This proves very different from that of *A. rosea*; and further, the habitats of the two species are separated by a forty mile range of wild mountain ridges and valleys which do not contain any species intermediate or connecting the two.

Achatinella Lyonsiana, n. sp. Pl. X, figs. 9, 10, 11.

Shell sinistral, imperforate, solid, ovate; spire convexly conical, apex obtuse; surface shining, striated with delicate growth lines; apical whorls smooth. Color white, with two reddish-brown bands, one encircling the base, the other passing around the periphery and revolving on the spire just above the suture; the two bands are sometimes confluent, and often the shell is uniform white, without bands. Whorls 6, narrowly margined above, somewhat convex; suture moderately impressed. Aperture oblique, white within, sinuately oval; peristome white, rather obtuse, thickened within, basal and columellar margins slightly expanded, extremities united by a very thin callus; columella terminating in a strong, tortuous, white fold.

Length, 17; diam., $11\frac{1}{2}$ mm.

Habitat, Konahuanui Mt., Island of Oahu; at an altitude of about 3,000 feet above sea level.

Animal: Mantle black, sometimes mottled with white, margined with a narrow line of lighter shade. Superior and under portion of foot light brown. Tentacles, tentacular sheath, and front above very dark brown.

The form of dentition of this and the other arboreal species of

Achatinella is given in the preface to this article. The species has a central tooth which is long and slender, with a small reflection and two minute cutting points. (H. Suter.)

This distinct species is dedicated to Prof. A. B. Lyons, of Oahu College, who has done much to stimulate the study of the Hawaiian land fauna.

***Achatinella Lymaniana*, n. sp.** Pl. X, figs. 12, 13.

Shell sinistral, very minutely perforated, solid, ovate; spire convexly conical, apex subacute; surface shining, covered with fine incremental lines, under a strong lens showing minute decussating striæ; apical whorls smooth, when not eroded. Color dark purplish brown, sometimes with longitudinal or transverse white flecks or zigzag lines; a white line traversing the suture; apex light chestnut. Whorls 6, very lightly margined above, somewhat convex; suture moderately impressed. Aperture oblique, white within, sublunate; peristome acute, thickened within, expanded, the columellar margin slightly reflexed and covering the small perforation, color white on both face and the reverse; columella white, terminating in a slightly developed flexuous fold.

Length, $20\frac{1}{2}$; diam., $11\frac{1}{2}$ mm.

Habitat, Waianae Mts., Island of Oahu.

No opportunity for an examination of the animal has yet occurred.

This species is typically very distinct from any other known species of the bulimoid section of *Achatinella*.

Named in honor of Mr. Ernest Lyman, to whom science is indebted for many additions to Hawaiian land shells.

Section APEX von Martens.

***Achatinella vespertina*, n. sp.** Pl. X, fig. 14.

Shell dextral, minutely perforated, solid, globose, with the spire conical, lateral outlines slightly concave, apex subacute; surface shining, striated with delicate growth lines; apical whorls smooth. Of a uniform delicate cream color, lighter on the upper whorls and sutures; sometimes with a few faint, white transverse lines on the lower whorl. Whorls 6, narrowly margined above, the first three plain, the rest slightly convex, the last somewhat inflated; suture lightly impressed. Aperture very oblique, oval, white within; peristome white, acute, thickened within, somewhat expanded, the basal

margin slightly reflected, the columellar margin forming a sinuous ridge around the umbilicus, extremities united by a very thin callosity; columella terminating in a strong, round, white tubercle.

Length, 21; diam. $14\frac{1}{2}$ mm.

Habitat, Kawailoa, Island of Oahu.

Animal when extended in motion, longer than the shell. Mantle and tentacles brown, the latter with the head above, of darker shade. Foot light yellow, the superior portion of darker hue.

The nearest allied species is *A. Swiftii* Newc.; but the shape and color of the shell, separate habitat, and difference of animal, entitle it to rank as a distinct species.

The native Hawaiians firmly believe in the power of *Achatinella* to produce musical sounds. Hence the Hawaiian name, "*pupu kanioe*," singing shells. Their legends ascribe to them a vesper song.

Achatinella Cookei, n. sp. Pl. X, fig. 15.

Shell dextral, subperforate, solid, globose, with spire regularly conical, apex subacute; surface shining, marked with fine incremental lines; the apical whorls smooth. Color, basal portion below the periphery jet black or sometimes brownish black, the apex white, rest of the shell very light brown, darker on the sutural margin. Whorls 6, margined above, the first three plain, the rest convex, the last inflated; suture well impressed. Aperture very oblique, oval, white within; peristome obtuse, slightly thickened within, narrowly reflexed, the columellar margin forming an obtuse, sinuous ridge, with the small umbilical cleft almost covered by it; extremities united by a thin callus; color purplish brown on both face and the reflexed portion; columella terminating in a strong, flexuous tubercle, tinged with purplish brown.

Length, 21; diam. 15 mm.

Habitat, Waiau, Ewa, Island of Oahu.

Animal: Mantle dark slate with a narrow brown band encircling the outer edge. Superior portion of foot light brown, mottled with slate, under surface dingy white.

This species is rare and very local in its distribution. It has affinities with *A. turgida* Newc., which is found in the same district, but differs somewhat in form and in the peristome. We are unacquainted with the animal of *A. turgida*. If it proves identi-

cal with that of *A. Cookei*, the latter must rank as a variety of the former.

Named in honor of Hon. C. M. Cooke, by whose sons the shell was discovered.

Section **PARTULINA** Pfeiffer.

Achatinella Dolei, n. sp. Pl. X, figs. 17, 18.

Shell sinistral, minutely perforated, somewhat solid, acuminate ovate conic, apex acute; surface shining, marked with delicate incremental striae, under a lens exhibiting extremely close, minute, decussating spiral striae; nuclear whorls faintly cross-lined. Color white, encircled below the periphery with a brownish black band, and at the periphery and above with more or less numerous, delicate, chestnut, spiral lines, which become fainter on the middle whorls and obsolete above. Whorls $6\frac{1}{2}$, narrowly margined above, convex; the last somewhat inflated, roundly angulated at the periphery and flattened on the base; suture deeply impressed. Aperture oblique, roundly ovate, flattened on the basal margin, white, exhibiting the brown markings of the exterior; peristome acute, angled at the periphery, slightly thickened within, expanded, basal and columellar margins narrowly reflexed; columella terminating in a long, flexuous, white plait.

Length, $24\frac{1}{2}$; diam. 14 mm.

Habitat, Honomanu, Island of Maui.

Animal when extended in motion longer than the shell. Mantle intensely black with a broad outer margin of yellow and a conspicuous orange spot in the center of the margin. Foot tapering behind, above and below light yellow. Tentacles long and slender, light slate. Head above lightly granulated.

The dentition of this and the preceding species, as observed by Mr. Suter, does not differ materially from that of the arboreal *Achatinellas* generally. In both of these species a long and slender central tooth is present.

We found this species very plentiful at the above locality, in the humid forests of the exterior slope of Haleakala crater, at an altitude of 7,000 feet above sea level. The dark band below the periphery is a constant feature. The nearest allied species is *A. splendida* Newc., of West Maui. It differs, however, from this in the sub-angulated periphery, flattened base, and untessellated upper

whorls. The animals are also different, and the habitats widely separated.

We take pleasure in dedicating this beautiful shell to His Excellency S. B. Dole, First President of the Republic of Hawaii, a gentleman noted for attainments in natural as well as political science.

Achatinella nivea, n. sp. Pl. X, fig. 19.

Shell sinistral, subperforate, somewhat solid, acuminate ovate conic, apex acute; surface highly polished, obliquely striated with fine lines of growth, and under a lens showing very close and delicate decussating spiral striæ; nuclear whorls faintly decussated. Color white, encircled with a narrow, pale chestnut band on or a little below the periphery. Whorls 7, slightly marginate above, flatly convex, the last with a somewhat angular periphery and flattened base. Suture slightly impressed.

Aperture oblique, roundly oval, white, the chestnut band of the exterior visible within. Peristome white, acute, thickened within, expanded, basal and columellar margins narrowly reflexed, extremities joined by a very thin white callus. Columella white, terminating in a moderately developed, flexuous plait.

Length, 24; diam. 14 mm.

Habitat, Makawao to Huelo, Island of Maui.

Animal when extended in motion longer than the shell. Mantle densely black with minute brown flecks and a broad yellowish band encircling the outer edge. Tentacles and superior portion of foot brown with a slight slate tinge; under portion of foot light brown. Front above covered with light granulations.

I have before me over 500 examples of this species, which are without variety in color or shape. The peripheral chestnut band is a constant feature. It may be readily distinguished from *Achatinella Tappaniana* Adams, by its more slender form and convex spire, by the sub-angulated periphery, flattened base, and more polished surface. The color of the animals is also very different; and the habitats are separated by a twenty-five mile expanse of low dry land, which is destitute of forests and molluscan life. In character of shell and animal it has some affinity with the preceding species; and, considering the remote habitats, the two may be regarded as distinct, but allied species.

Achatinella mucida, n. sp. Pl. X, fig. 23.

Shell sinistral, very minutely perforated, solid, acuminate ovate

conic, apex rather acute; surface shining, marked with fine growth lines, and under a lens decussated by very delicate, close, spiral striae. The shell of an ashy gray color, irregularly distributed over the surface, giving it a mucid appearance; with a dark brown band at the periphery which becomes sutural, extending both above and below the suture, and a small patch of the same color around the umbilicus; also with a few inconspicuous brown lines on the base and above the periphery, the latter continued above; apical whorls generally denuded of cuticle, and then of a light chestnut color. Whorls 7, slightly convex; suture moderately impressed. Aperture oblique, oval, livid white within; peristome acute, slightly thickened within, expanded, basal and columellar margins narrowly reflexed, light brown on both face and the reverse; columella tinged with brown, terminating in a strong, plaited, projecting tooth.

Length, $21\frac{1}{2}$; diam. $11\frac{1}{2}$ mm.

Habitat, Makakupaia, Island of Molokai.

This species is found in the region intervening between the habitats of *A. Redfieldii* Newc. and *A. compta* Pse.; and it has characteristics connecting it with each of these species. It is smaller than either, and differs from both in the coloration, particularly from the former in the absence of the white sutural band.

Achatinella Anceyana, n. sp. Pl. X, fig. 16.

Shell dextral, imperforate, rather thin, ovately conical, apex obtuse; surface shining, striated with fine growth lines, under a lens exhibiting a beautiful pattern of close, delicate, decussating, spiral striae, which extend to the very apex. Color reddish brown, becoming paler towards the summit; with two yellow bands, a broad one encircling the umbilical-region, a narrow one at the periphery, the latter margined above with a delicate white line, which is continued on the spire just above the suture and becomes lost on the third whorl; also with a narrow white line revolving below the suture to the very tip of the apex. Whorls 5, convex, not marginate; suture distinctly impressed. Aperture a little oblique, oval, white, distinctly exhibiting the dark coloring of the exterior; peristome acute, slightly thickened within, the coloring of the outside appearing on the inner edge; columella brown, terminating in a well developed, flexuous fold.

Length, $14\frac{1}{2}$; diam. 9 mm.

Habitat, Makawao, Island of Maui.

Animal when extended in motion longer than the shell. Mantle light brown mottled with black, outer edge encircled with an interrupted orange band. Foot above and below a very light brown, superior portion with a slate tinge, posterior portion tapering and sometimes with a yellowish tinge. Tentacles long, light slate. Head above minutely granulated.

This species was collected in the forests of the exterior slope of the extinct Haleakala crater, at an altitude of 4,000 feet above sea level. Owing to its peculiar habit of living on the foliage near the tops of trees, it has escaped previous observation.

The species has no known congeners. It is remarkable for the constancy of its delicate color lines. Over 200 examples before me show only trifling divergence in this respect.

Named in honor of Mr. C. F. Ancey, whose publications have contributed largely to our knowledge of Hawaiian land shells.

Achatinella *Horneri*, n. sp. Pl. X, figs. 20, 21, 22.

Shell sinistral, minutely perforated, thin, globose with a short acutely conical spire, apex acute; surface shining, striated with fine incremental lines, and under a lens exhibiting very close and delicate decussating spiral striæ; embryonic whorls faintly cross-lined. Color dull white, encircled at the periphery with a faint brown zone which is continued on the suture, also with a very small patch of same color around the umbilicus. Whorls 6, the upper five slightly convex, the last very much inflated, forming the greater part of the shell; suture distinctly impressed. Aperture oblique, sub-rotund, very large, white within, distinctly showing the external peripheral band; peristome margined with light brown, rather thin, very slightly thickened within, expanded, basal and columellar margins narrowly reflexed, extremities slightly converging and united by a thin callus; columella light brown, very slightly developed, plain and smooth.

Length, 24; diam. 18 mm.

Habitat, Hamakua, Island of Hawaii.

Animal in motion longer than the shell. Mantle black, margined with gray. Foot above and below gray, the superior portions lightly granulated. Tentacles light gray.

There occurs also a pure white form of the shell without the peripheral band, and a form white with a light chestnut band on the apical whorls. The animals of these varieties vary only a trifle from that of the typical form.

This species belongs to the group of *A. physa* Newc., but is easily distinguished by its much more inflated body whorl and smaller spire, its smoother and polished surface. The habitats of the two species are widely separated, and the animals are entirely different. The animal of *A. physa*, mantle and foot, is a dingy white with a greenish yellow tinge.

We dedicate the species to Mr. J. Lewis Horner, the young naturalist to whom science is indebted for the discovery of this and the following species. They are valuable additions to the shells of the Island of Hawaii, which has heretofore furnished only one described arboreal species of *Achatinella*.

***Achatinella Hawaiiensis*, n. sp.** Pl. X, figs. 24, 25, 26.

Shell sinistral, minutely perforated, very thin, acutely conical, apex acute; surface rather lusterless, covered with fine lines of growth, and under a lens showing extremely close and delicate decussating spiral lines; nuclear whorls faintly decussated. Color very variable, plain brown or dingy white, sometimes irregularly striped or mottled with brown and white, the base generally uniform brown, but sometimes with undulating markings of brown and white; the only constant characters being a brown, sometimes interrupted, line at the periphery, bordered below with a broader white line. Whorls 6, slightly convex, the last inflated. Suture lightly impressed.

Aperture oblique, oval, brown, the peripheral brown and white bands distinctly marked within. Peristome acute, not thickened within, external margin straight, basal expanded, the expanded portion being very thin and fragile, the columella margin reflexed over the minute perforation; color white on both face and the reverse. Columella white, very slightly developed, plain and smooth.

Length, 18; diam. $10\frac{1}{2}$ mm.

Habitat, Hamakua, Island of Hawaii.

Animal when extended in motion longer than the shell. Mantle almost white, margin of a darker shade. Foot above and below

dingy white, superior portion sometimes flecked with gray. Tentacles of darker shade.

The dentition is the same as that of the arboreal *Achatinellas* generally. A central tooth is present; and the formula of dentition is $125-1-125 \times 120 = 30,120$. (Prof. Gwatkin.)

This species also belongs to the group of *A. physa* Newc., but is readily distinguished by its much smaller size, smoother surface, delicate lip, and arrangement of colors. The habitats are also widely separated and the animals different.

Achatinella Theodori, n. sp. Pl. X, fig. 27.

Shell sinistral, subperforate, rather thin, elongately conical, apex subacute; surface shining, sculptured with somewhat irregular incremental striæ, and under a lens exhibiting extremely close and minute decussating spiral striæ; nuclear whorls smooth. Color dingy white, striped and mottled irregularly with longitudinal dark brown streaks. Whorls 7, lightly marginate above, slightly convex; suture moderately impressed. Aperture oblique, oval, purplish brown within; peristome acute, margined with brown, very lightly thickened within, columellar margin slightly reflexed; columella terminating in a slight, flexuous, brown fold.

Length, $18\frac{1}{2}$; diam. 9 mm.

Habitat, Kawela, Island of Molokai.

The animal has not as yet been observed. The shell belongs to the group of small elongately conical *Partulina* for which Mr. Harper Pease proposed the name *Perdicella* as a subgeneric title.

The nearest allied species is *A. ornata* Newc., which is of much smaller size, more delicate markings, has a peripheral dark band, and inhabits a different island.

Section **NEWCOMBIA** Pfeiffer.

Achatinella canaliculata, n. sp. Pl. X, figs. 28 29.

Shell sinistral, very minutely perforated, somewhat solid, acuminately turreted, apex subacute; surface sculptured throughout with numerous acute, spiral keels, which become blunter as they approach the apex, the interstices between the keels exhibiting under a lens very delicate growth striæ. Color brown, upper whorls tessellated with brown and white. Whorls 6, slightly convex, lower one somewhat flattened at the base; suture lightly impressed. Aperture oblique, oval, livid white or light brown

within ; peristome acute, very lightly thickened within, expanded, columellar margin reflexed over the small perforation, margined with light brown on both face and the reverse ; columella very slightly developed, plain and smooth.

Length, 14 ; diam. $6\frac{1}{2}$ mm.

Habitat, Halawa, Island of Molokai.

Animal when extended in motion as long as the shell. Mantle slate color, margined with brown. Foot light slate, studded on the sides and head above with spots of deeper shade. Tentacles short and slender, dark slate.

The nearest allied species is *A. sulcata* Pfr., from which it may be distinguished by its smaller size and more acute keels ; the animals also differ and the habitats are widely separated.

Section LAMINELLA Pfeiffer.

Laminella helvina, n. sp. Pl. XI, fig. 30.

Shell sinistral, imperforate or subperforate, sometimes narrowly and deeply perforated, rather thin, elongately conical, apex rather acute ; surface scarcely shining, covered with very fine incremental striæ ; nuclear whorls smooth. Color uniform light or dingy yellow, with a few black markings on the upper whorls. Whorls $6\frac{1}{2}$, lightly margined above, convex ; suture deeply impressed. Aperture a little oblique, oval, white, with the tint of the outside ; peristome simple, thin, margins connected by a thin, orange-yellow callus ; columella biplicate, the terminal plication a thin, oblique lamellar plait, the inner one less prominent, tortuous, of an orange yellow color.

Length, 18 ; diam. 10 mm.

Habitat, Ohia valley, near Kaluaaha, Island of Molokai.

Animal extended in motion as long as the shell. Mantle and foot above and below very light brown. Tentacles dark slate, with a sprinkling of slate on the sides of the foot. Posterior portion of foot very tapering and thickly studded with minute red spots. A remarkably prolific species ; 4 or 5 embryonic shells in successive stages of growth often observed in the oviducts. A jaw is present and the dentition is the same as that of the *Amastra* species. The tooth formula of this species is $32.1.32 \times 108 = 7,020$. The central tooth is a little wider than usual. (Prof. Gwatkin.)

This shell differs from all its congeners in its strongly biplicate

columella, and the peculiar soft parts of the animal. The typical forms are found in the small valley of Ohia on Molokai. Departing from this locality on either side, modified forms without the biplicate columella are somewhat common.

Laminella depicta, n. sp. Pl. XI, figs. 33, 34, 35.

Shell sinistral, sometimes slightly perforated, rather thin, elongately conical, apex subacute; surface shining, striated with very delicate growth lines; nuclear whorls smooth. Color light yellow or reddish yellow, plain, or marked with numerous black, anastomosing veins; apex almost black in some examples. Whorls 7, faintly margined above, somewhat convex, suture distinctly impressed. Aperture a little oblique, oval, white or pinkish, the outside markings visible within; peristome simple, very thin; columella white, sub-biplicate, tortuous, abruptly terminating in a thin lamellar plait.

Length, $15\frac{1}{2}$; diam. $6\frac{1}{2}$ mm.

Habitat, Kamalo, Island of Molokai.

Animal extended in motion shorter than the shell. Mantle very light brown. Foot above and below almost white. Tentacles short, light brown.

This species is allied to *A. Alexandri* Newc., from the Island of Maui, and to *A. Remyi* Newc., from the Island of Lanai, but differs from both in the color and habits of the animal.

Section **AMASTRA** H. & A. Adams.

Amastra pullata, n. sp. Pl. XI, figs. 31, 32.

Shell dextral, imperforate, solid, elongately ovate; surface lusterless, covered with rather close, irregular, growth striæ; the embryonic whorls finely radiately sulcated. Color light brown; covered with a black fugacious epidermis, dense on the last whorl, more sparsely distributed on the upper whorls, worn off in front of the aperture; apex dark brown. Whorls 7, convex; suture well impressed. Aperture oval, a trifle oblique, white within with a purplish tinge; peristome acute, slightly thickened within, edge dark purple; columella purplish white, flexuous, abruptly terminating in a broad, thin, slightly arched lamellar plait.

Length, 23; diam. $11\frac{1}{2}$ mm.

Habitat, Waikolu, Island of Molokai.

Animal extended in motion a trifle longer than the shell. Mantle

almost white with a slate tinge. Foot above and below almost white, the posterior portion and edges densely studded with very minute pink spots. Tentacles short, light slate, with a few spots of the same color on the head above.

All the *Amastra* species are terrestrial in their habits ; their form of dentition is given in the preface to this article. The formula for this species is $28.1.28 \times 99 = 5,645$. (Prof. Gwatkin.)

Unlike most of the *Amastra*, which generally have dark dingy colored animals, this species has a beautiful, almost white animal. The after portion and edges of the foot under a lens are seen to be closely studded with minute pink spots which give these parts a delicate pink hue.

Amastra umbrosa, n. sp. Pl. XI, figs. 36, 37.

Shell dextral, imperforate, solid, globosely ovate-conic ; surface lustreless, covered with close, rather regular growth striæ ; the lower whorls spirally malleated ; the embryonic whorls finely radiately sulcated. Color white, apex dark chestnut ; nearly the whole surface covered with irregular streaks of a black, fugacious epidermis, worn off in front of the aperture. Whorls 6, slightly convex, the last somewhat inflated. Aperture ovate, a little oblique, white within ; peristome acute, thickened within, expanded ; columella white, flexuous, abruptly terminating in a somewhat thick lamellar plait.

Length, 21 ; diam. $12\frac{1}{2}$ mm.

Habitat, Kamalo, Island of Molokai.

Animal extended in motion longer than the shell. Mantle dark brown with a margin of lighter shade. Foot light brown, the superior portion and sides studded with large spots of deeper shade. Tentacles short, stout, very dark brown.

The formula of dentition is 28.1.28. The marginals take a peculiar form. (Prof. Gwatkin.)

Amastra rubicunda, n. sp. Pl. XI, fig. 38.

Shell dextral, imperforate, rather solid, elongately ovate-conic ; surface lustreless, striated with irregular growth striæ ; embryonic whorls smooth. Color reddish, with traces of a deciduous, thin, brown epidermis. Whorls 7, slightly convex ; suture well impressed. Aperture elongately oval, a trifle oblique, rather small, purplish red within ; peristome simple, thin, margined with dark

purple; columella white with a purple tinge, flexuous, abruptly terminating in a thin, slightly curved lamellar plait.

Length, 19; diam. 9 mm.

Habitat; Konahuanui Mt., Island of Oahu.

Animal, mantle brown, margin of a deeper shade. Foot brown, the superior portion almost black. The formula of the dentition is 18.10.1.10.18. (H. Suter.)

In form and general appearance this species resembles *Amastra variegata* Pfr., which inhabits a different station, and is readily distinguished by its less ruddy color, sulcated apex, and essential difference of animal.

Amastra undata, n. sp. Pl. XI, fig. 39.

Shell dextral, imperforate, solid, ovate, spire convexly conical, apex rather acute, base somewhat attenuated; surface lustreless, closely and rather evenly ribbed in the direction of the growth lines, the rib-striae being slightly interrupted by several coarse, transverse spiral lines, the nuclear whorls finely radiately sulcated. Color light brown and dark chestnut, alternating in irregular longitudinal undulations. Whorls 6, slightly convex; suture moderately impressed. Aperture a trifle oblique, sublunate, rather small, white within; peristome acute, slightly thickened within; columella white flexuous, abruptly terminating in a thin, slightly arched, lamellar plait.

Length, 17; diam. 12 mm.

Habitat; Nuuanu, Island of Oahu.

This species is very rare and local in its distribution. Its principal features are the prominent rib-striae and the beautiful undulating markings of light and dark chestnut brown.

Amastra badia, n. sp. Pl. XI, fig. 40.

Shell dextral, imperforate, rather thin, elongately ovate-conic; surface shining, sculptured with delicate, rather close thread-like rib-striae in the direction of the growth lines; embryonic whorls radiately sulcated. Color dark chestnut-brown with light brown zigzag or undulating lines and markings. Whorls $6\frac{1}{2}$, slightly convex; suture moderately impressed. Aperture oval, a trifle oblique, livid white within, exhibiting the brown color of the exterior; peristome acute, very lightly thickened within; columella white, flexuous, abruptly terminating in a thin, slightly arched lamellar plait.

Length, $20\frac{1}{2}$; diam. $10\frac{1}{2}$ mm.

Habitat, Ewa, Island of Oahu.

The distribution of this species, as far as observed, is quite limited. We do not know of any species approaching it in form or specific characteristics. Its somewhat smooth and polished surface distinguishes it from most of the species of the *Amastra* section.

Amastra pellucida, n. sp. Pl. XI, figs. 41, 42.

Shell dextral, imperforate, very fragile, thin, translucent, globosely conic, apex rather acute; surface lusterless, sculptured with fine incremental lines, apical whorls smooth. Color light-brown, apex darker; destitute of epidermis. Whorls $5\frac{1}{2}$, somewhat convex; suture moderately impressed. Aperture oval, a trifle oblique, livid-white within; peristome simple, thin; columella white, flexuous, abruptly terminating in a thin lamellar plait.

Length, $12\frac{1}{2}$; diam. 8 mm.

Habitat, Waianae Valley, Island of Oahu.

Animal of a uniform brown color; the head above and tentacles of a darker shade. The action of the heart is plainly visible through the thin texture of the shell. When first collected the pulsations were about fifty per minute, growing slower and fainter from day to day until the animal died.

This species is well characterized by its thin pellucid texture, globose form, abbreviated spire, and light brown color.

Amastra breviata, n. sp. Pl. XI, figs. 45, 46.

Shell dextral, very minutely perforated, rather thin, globosely conical, apex rather acute; surface not polished, covered with fine incremental lines, the nuclear whorls smooth. Color corneous-brown, destitute of an epidermis. Whorls 6, slightly convex; suture well impressed. Aperture a trifle oblique, oval, livid-white within, showing the color of the exterior; peristome simple, thin, extremities joined by a thin white or brown callosity; columella white, flexuous, abruptly terminating in a thin lamellar plait.

Length, $12\frac{1}{2}$; diam. $7\frac{1}{2}$ mm.

Habitat, Palolo and Halawa, Island of Oahu.

This shell approaches the preceding species in its form; but may be readily distinguished by its thicker texture and darker color. The habitats are also widely separated and the animals differ.

Amastra tenuispira, n. sp. Pl. XI, fig. 51.

Shell dextral, imperforate, solid, acuminate, turreted, spire conical, apex subacute; surface lustreless, covered with somewhat rude, irregular incremental striæ; the embryonic whorls very finely, radiately sulcated. Color light-brown, upper whorls darker; covered with an earthy brown, fugacious epidermis. Whorls 7, somewhat convex, in some examples slightly margined above; suture well impressed. Aperture oval, oblique, rather small, light-brown within; peristome simple, acute, extremities united with a thin callosity; columella sub-biplicate, light-brown, tortuous, abruptly terminating in an oblique, dentiform plait.

Length, 17; diam. $6\frac{1}{2}$ mm.

Habitat, Kaala Mt., Island of Oahu.

This species is very local in its habitat. Its only congeners are the elongate forms *Amastra Hutchinsónii* Pse., which inhabits East Maui, and *Amastra moesta* Newc. from the island of Lanai. The former is remarkable as the only known sinistral species of the *Amastra* section, and is also distinguished by its invariably white aperture and columella fold. The latter species is characterized by its more obese form and peculiar columella.

Amastra nana, n. sp. Pl. XI, figs. 48, 49.

Shell dextral, imperforate, rather thin, ovately conical, apex subacute; surface lustreless, striated with fine incremental lines, the $2\frac{1}{2}$ embryonic whorls finely, radiately sulcated. The color varies from light to dark brown, the basal half of the body whorl sometimes of lighter shade than the upper portion; covered with a black or earthy-brown, fugacious epidermis, often laid on with alternating undulations, or zigzag markings. Whorls 6, somewhat convex; suture well impressed. Aperture oval, a little oblique, white with a purplish tinge; peristome simple, very thin; columella purplish-white, flexuous, abruptly terminating in a thin lamellar plait.

Length, 11 $\frac{1}{2}$; diam. $6\frac{1}{2}$ mm.

Habitat, Makawao, Island of Maui.

Animal when extended in motion as long as the shell. Mantle light brown. Foot above and below brown with spots of deeper shade on the sides. Tentacles and front above almost black.

This is one of the smaller of the *Amastra* forms. It is about the size of *Amastra petricolor* Newc. from Molokai, and *Amastra umbili-*

cata Pfr. from Oahu; species possessing entirely different characteristics.

Common, but very local in its distribution, in a belt of forest land about 4,000 feet above sea level.

Amastra antiqua, n. sp. Pl. XI, fig. 47.

Shell fossil, dextral, narrowly but deeply perforated, the perforation penetrating almost to the apex; solid, elongately ovate, apex subacute; surface sculptured with rude, irregular lines of growth, the apical whorls smooth. Color of the living shell unknown. Whorls 6, convex; suture well impressed. Aperture a trifle oblique, sublunate; peristome thickened within, columellar margin adnate, slightly expanded over the umbilicus, extremities somewhat converging and united by a thick parietal callosity; columella flexuous, terminating in a narrow plait.

Length, 20; diam. 12 mm.

Habitat, Ewa, Island of Oahu.

We received this species from Prof. A. B. Lyons, of Oahu College. He reports that he found at Ewa a singular accumulation of these and other fossil land shells, huddled together in one spot in a bed of soft tufa-like material, at an altitude not far above sea level. The existence of living examples of this and the following species now, or within any recent period, is highly improbable.

Amasta vetusta, n. sp. Pl. XI, fig. 50.

Shell fossil, dextral, imperforate, solid, ovately conical, apex rather acute; surface sculptured with somewhat regular, close rib-striae in the direction of the growth lines, with a few faint cross lines; the embryonic whorls radiately sulcated. Color of living shell unknown. Whorls $6\frac{1}{2}$, very slightly convex; suture lightly impressed. Aperture sinuately oval, a little oblique; peristome flatly blunt, thickened on the inner edge, margins united with a thick callosity; columella flexuous, abruptly terminating in a small, thin plait.

Length, 13; diam. $7\frac{1}{2}$ mm.

Habitat, near Honolulu, Island of Oahu.

This species was also discovered by Prof. Lyons. It occurs near the base of Punchbowl Hill, at an altitude of twenty or thirty feet above sea level, in a conglomerate of volcanic tufa and sand cemented together with carbonate of lime. Prof. Lyons thinks the shells must have lived near the spot where they are now found embedded

in the rock, as there is no satisfactory way to account for their transportation from any distance. If so, the conditions of climate when the shells flourished in that locality, must have been quite different from those of the present time.

Amastra cyclostoma, n. sp. Pl. XI, fig. 53.

Shell dextral, narrowly but deeply perforated, the perforation penetrating to the apex, somewhat solid, oblately globular with a short conical spire, apex acute; surface lustreless, sculptured with close, obliquely descending, flexuous growth lines, which become concentric around the umbilicus; the embryonic whorls smooth or with delicate, radiating sulcations. Color brown, darker on the spire. Whorls 6, the upper ones rather flat, rapidly increasing; the last one large, forming the greater part of the shell, strongly angled at the periphery, the angle becoming almost obsolete towards the aperture, deflexed in front a trifle below the carina, surface above the angle flat, slightly convex towards the aperture, and rounded below the angle; suture well impressed. Aperture very oblique, sinuately circular, a small segment cut off by the penultimate whorl, livid-white within, exhibiting the exterior coloring through its substance; peristome rather obtuse, slightly thickened within, unreflected, extremities slightly converging and united by a very thin callosity; columella livid-white, broad and flat, terminating in a slight, flexuous plait.

Altitude, 15; diam. 18 mm.

Habitat, Makaweli, Island of Kauai.

Animal when extended in motion .95 inch in length; posterior portion of foot tapering and very short, front portion long; head elongated, ocular and labial tentacles widely separated. Mantle dingy-white with streaks of black. Foot very light brown, superior portion and sides thickly studded with regular, dark brown granulations. Tentacles long, dark brown.

This species belongs to the same group as *Amastra sphaerica* Pse. and *Amastra heliciformis* Anc., but may be readily distinguished from both by its much larger size and more inflated body whorl.

Amastra Knudsenii, n. sp. Pl. XI, figs. 43, 44.

Shell dextral, imperforate, solid, elongately ovate, spire conical, apex subacute; surface lustreless, coarsely and irregularly wrinkled by growth striæ; embryonic whorls very finely radiately sulcated.

Color very dark brown, tending to a lighter shade on the elevated portions of the lower whorl. Whorls 7, the three lower ones strongly angulated a little below the suture, the last one with a cord-like keel at the periphery and numerous coarse cross striæ above and below the periphery; suture well impressed. Aperture oblique, elongately oval, dark purple inside with a satin-like lustre; peristome acute, not thickened within; columella terminating in a long, narrow, flexuous, pearly-white plait.

Length 33; diam. 17 mm.

Habitat: Halemanu, Island of Kauai.

Both this species and *Amatra Kauaiensis* Newc. are characterized by the long, flexuous thread-like columellar plait which is peculiar to the genus *Carelia* of Kauai. Examination of the animals may prove them both aberrant forms of that genus.

The species is very rare. We dedicate it to Mr. A. Knudsen, the young naturalist who discovered it. He writes that it is of very limited distribution, being found far up the mountain only in an isolated tract of wood land which escaped the forest fires of twenty years ago. In three days' diligent search he found only twelve living examples.

EXPLANATION OF PLATES.

The figured types are, with the exceptions noted below, in the collection of the Academy of Natural Sciences, bearing the numbers quoted in parenthesis.

PLATE X.

FIGURES.

FIGS. 1, 2.	<i>Achatinella multizonata</i> Baldwin	(65,703)
“ 3, 4.	<i>Achatinella Juddii</i> Baldwin	(65,709)
“ 5, 6.	<i>Achatinella Ernestina</i> Baldwin	(65,706)
“ 7, 8.	<i>Achatinella luteostoma</i> Baldwin	(65,704,65,705)
“ 9.	<i>Achatinella Lyonsiana</i> Baldwin	(65,693)
“ 10.	<i>Achatinella Lyonsiana</i> var.	(coll. Baldwin)
“ 11.	<i>Achatinella Lyonsiana</i> var.	(65,694)
“ 12, 13.	<i>Achatinella Lymaniana</i> Baldwin	(coll. Baldwin)
“ 14.	<i>Achatinella vespertina</i> Baldwin	(65,699)
“ 15.	<i>Achatinella Cookei</i> Baldwin	(65,692)

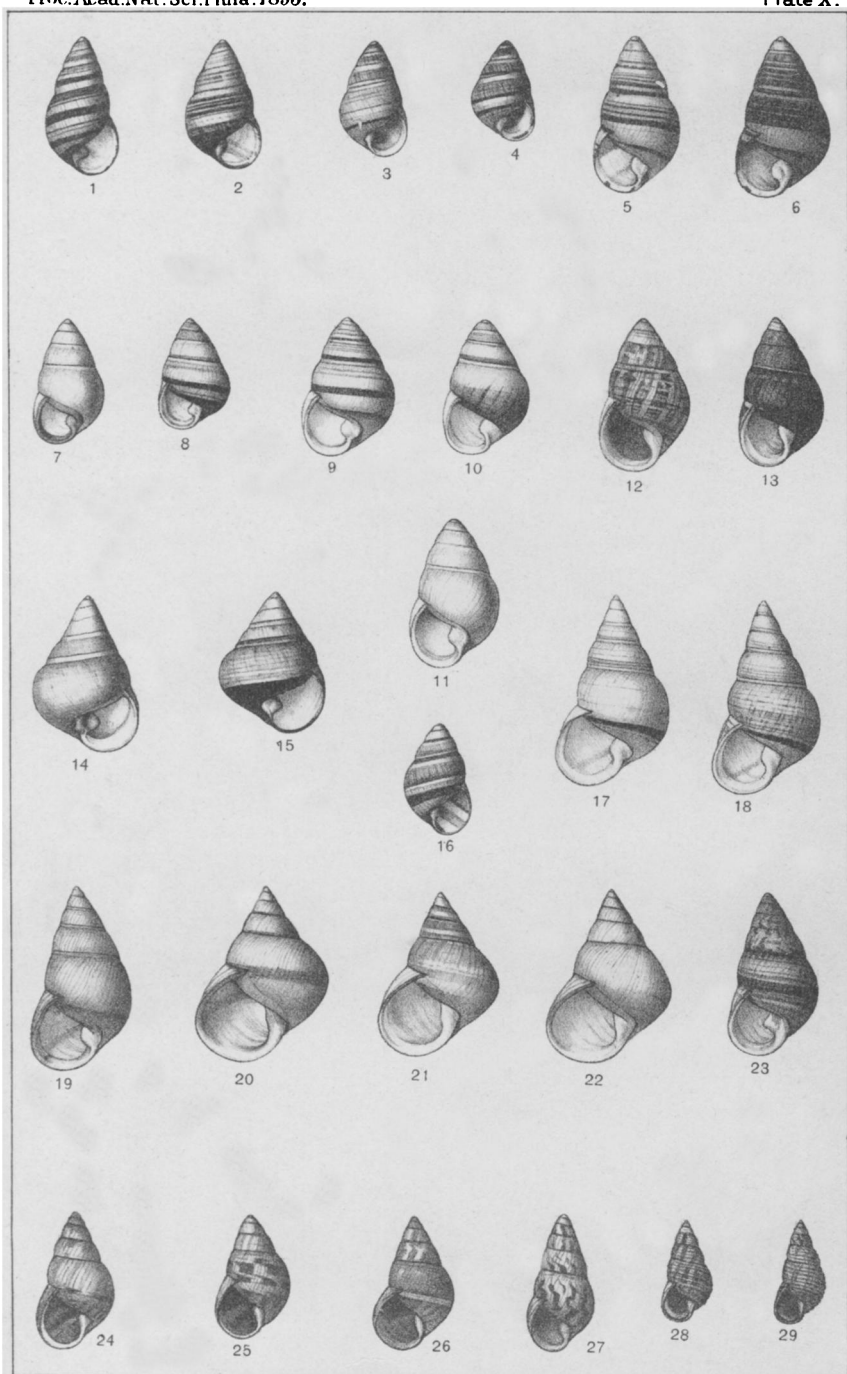
FIGURES.

- “ 16. *Achatinella Anceyana* Baldwin (65,707)
 “ 17, 18. *Achatinella Dolei* Baldwin (65,690)
 “ 19. *Achatinella nivea* Baldwin (65,691)
 “ 20. *Achatinella Horneri* Baldwin (65,702)
 “ 21. *Achatinella Horneri* var. (65,700)
 “ 22. *Achatinella Horneri* var. (65,701)
 “ 23. *Achatinella mucida* Baldwin (65,708)
 “ 24. *Achatinella Hawaiiensis* Baldwin (65,695)
 “ 25. *Achatinella Hawaiiensis* var. (65,696)
 “ 26. *Achatinella Hawaiiensis* var. (65,698)
 “ 27. *Achatinella Theodorei* Baldwin (65,710)
 “ 28, 29. *Achatinella canaliculata* Baldwin (65,713)

PLATE XI.

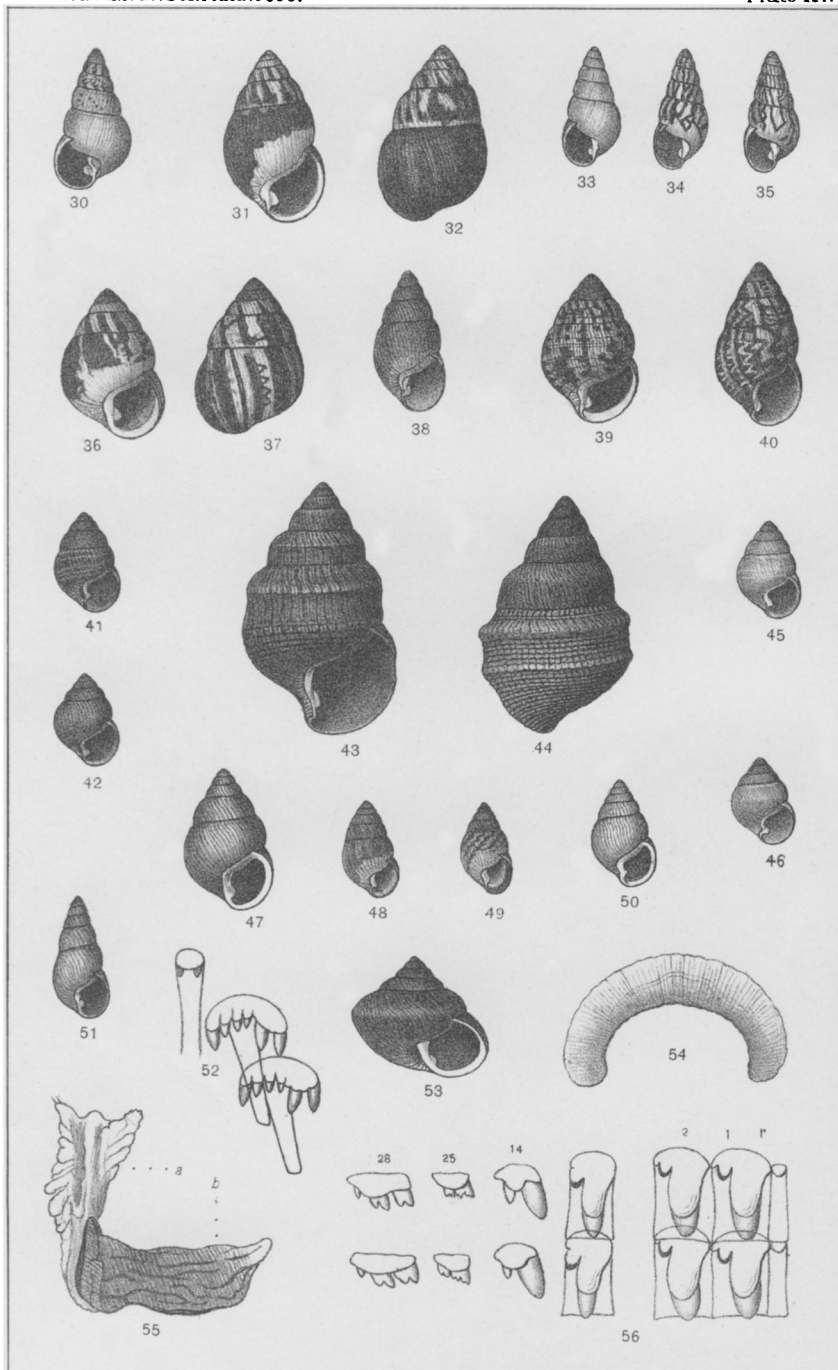
FIGURES.

- “ 30. *Laminella helvina* Baldwin (65,712)
 “ 31, 32. *Amastra pullata* Baldwin (65,715)
 “ 33, 34, 35. *Laminella depicta* Baldwin (65,711)
 “ 36, 37. *Amastra umbrosa* Baldwin (65,714)
 “ 38. *Amastra rubicunda* Baldwin (65,719)
 “ 39. *Amastra undata* Baldwin (65,722)
 “ 40. *Amastra badia* Baldwin (coll. Baldwin)
 “ 41, 42. *Amastra pellucida* Baldwin (65,721)
 “ 43, 44. *Amastra Knudseni* Baldwin (65,725)
 “ 45, 46. *Amastra breviata* Baldwin (65,723)
 “ 47. *Amastra antiqua* Baldwin (65,716)
 “ 48, 49. *Amastra nana* Baldwin (65,718)
 “ 50. *Amastra vetusta* Baldwin (65,717)
 “ 51. *Amastra tenuispira* Baldwin (65,720)
 “ 52. *Achatinella Lyonsiana* Baldwin. Rhachidian tooth with two adjacent lateral teeth.
 “ 53. *Amastra cyclostoma* Baldwin (65,724)
 “ 54. *Amastra rubicunda* Baldwin jaw.
 “ 55. *Achatinella Dolei* Baldwin, *a* chitinous membrane, and *b* radula, as obtained after treatment with caustic potash.
 “ 56. *Amastra rubicunda* Baldwin. Rachidian teeth, with 1st, 2d and 10th lateral teeth, and marginals 14, 25 and 28.



W H C Sheppard, del. et. Lith.

BALDWIN ON ACHATINELLA.



Edwin Sheppard, del. et. Lith.

BALDWIN ON ACHATINELLA.